CAREERS IN EARTH SCIENCE

Geochemistry Some geochemists study the interaction of rocks, minerals and the environment. They can help mining companies reduce the amount of contamination from waste piles by understanding how the rocks and minerals break down and how toxic the byproducts might be. For more information on Earth science careers, visit glencoe.com.

The most common acid in Earth's environment is carbonic acid (H_2CO_3), which is produced when carbon dioxide (CO_2) is dissolved in water (H_2O) by the following reaction.

$$H_2O + CO_2 \rightarrow H_2CO_3$$

Some of the carbonic acid (H_2CO_3) in the water ionizes, or breaks apart, into hydrogen ions (H^+) and bicarbonate ions (HCO_3^-), as represented by the following equation.

$$H_2CO_3 \rightarrow H^+ + HCO_3^-$$

These two equations play a major role in the dissolution and precipitation of limestone and the formation of caves, discussed in Chapter 10. Many of the reaction rates involved in geological processes are very slow. For example, it might take thousands of years for enough carbonic acid in limestone to dissolve in groundwater and produce a cave.

Bases A **base** is a substance that produces hydroxide ions (OH^-) in water. A base can neutralize an acid because hydrogen ions (H^+) from the acid react with the hydroxide ions (OH^-) from the base to form water through the following reaction.

$$H^+ + OH^- \rightarrow H_2O$$

Refer again to **Figure 3.15.** A solution with a reading above 7 is considered to be basic. The higher the number, the more basic the solution. Distilled water usually has a pH of 7, but rainwater is slightly acidic, with a pH of 5.0 to 5.6. The pH values of some common substances are shown in **Figure 3.15.**

Section 3.2 Assessment

Section Summary

- Atoms of different elements combine to form compounds.
- Covalent bonds form from shared electrons between atoms.
- Ionic compounds form from the attraction of positive and negative ions.
- There are two types of mixtures—heterogeneous and homogeneous.
- Acids are solutions containing hydrogen ions. Bases are solutions containing hydroxide ions.

Understand Main Ideas

1. MAIN Idea **Explain** why molecules do not have electric charges.
2. **Differentiate** between molecules and compounds.
3. **Calculate** the number of atoms needed to balance the following equation:
   $CaCO + HCl \rightarrow CO_2 + H_2O + CaCl$
4. **Diagram** how an acid can be neutralized.
5. **Compare and contrast** mixtures and solutions by using specific examples of each.

Think Critically

6. **Design** a procedure to demonstrate whether whole milk, which consists of microscopic fat globules suspended in a solution of nutrients, is a homogeneous or heterogeneous mixture.
7. **Predict** what kind of chemical bond forms between nitrogen and hydrogen atoms in ammonia (NH_3). Sketch this molecule.

WRITING in Earth Science

8. Antacids are used to relieve indigestion and upset stomachs. Write an advertisement for a new antacid product. Explain how the product works in terms that people who are not taking a science class will understand.

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